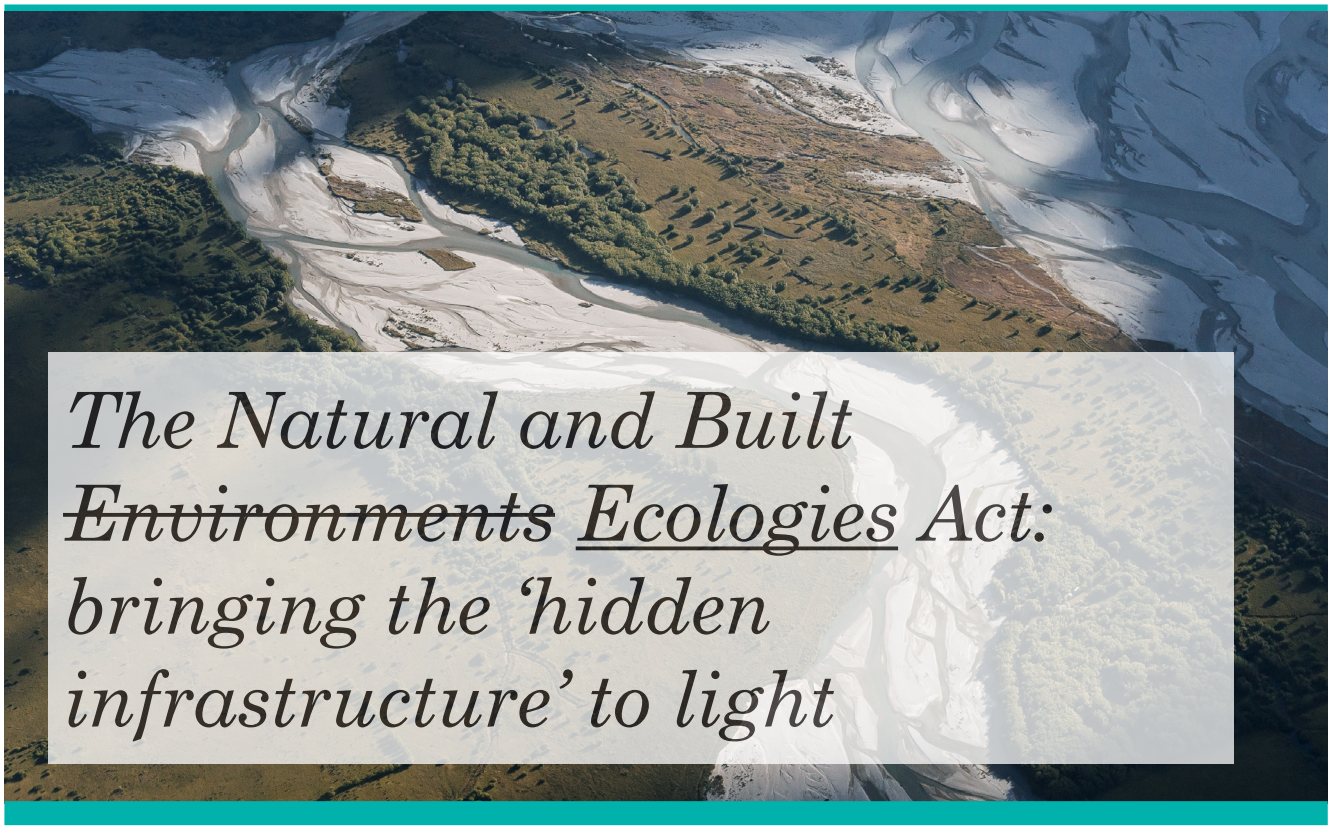

The Natural and Built ~~Environments~~ Ecologies Act: bringing the 'hidden infrastructure' to light

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Over 200 years ago, the renowned scientist and naturalist Alexander von Humboldt drew attention to the effects of deforestation on soil erosion, sedimentation of waterways, and its disruptive effects on climate.

Travelling through Venezuela in search of the source of the Orinoco River, Humboldt's description of land use practices is eerily reminiscent to clearfelling today on steeplands in Gisborne, Tasman and Marlborough:

> *"When forests are destroyed…whenever great rain falls from the heights…the waters falling in rain are no longer impeded in their course; and instead of slowly augmenting the level of the rivers by progressive filtration, they furrow during heavy rain showers the sides of the hills, bear down the loosened soil…[and] devastate the country" [Andrea Wulf "The invention of nature" (2015) John Murray].*

Humboldt described nature as a "living whole" with a "net-like intricate fabric" of organisms, which are "made mutually dependent on each other", in laying the foundations for the modern science of ecology [Wulf at 245]. This interdependent and interconnected view is also reflected in Te Ao Māori and other Indigenous cultures.

Since Humboldt's time, many ecological studies have revealed the importance of diversity in biological communities for ecosystem stability and resilience. Resilience can be defined as the capacity of a habitat or ecosystem "to absorb disturbance or reorganize while undergoing change so as to retain essentially the same function, structure, identity, and feedbacks" [Carl Folke and others "Regime shifts, resilience, and biodiversity in ecosystem management" (2004) 35 Annual Review of Ecology, Evolution, and Systematics 557].

Unfortunately, our forestry and fishing methods often involve extensive clearfelling to extract fibre or protein. These methods destabilise soils and sediments resulting in sedimentation and habitat damage from heavy machinery. Not only are hillsides being eroded at an alarming rate, but old sediments that are a legacy of past mining, deforestation and pastoralism are remobilised into the water column by heavy dredges and trawl gear.

These practices occur annually over millions of hectares of land and sea each year [Ministry for the Environment and Statistics New Zealand "Environment Aotearoa 2019"]; are inimical to ecological resilience and biodiversity; and

contribute to climate change by releasing labile carbon into the water column where conversion into carbon dioxide by remineralisation can occur and emission to the atmosphere [New Zealand Marine Sciences Society "Submission - Climate Change Commission: Draft Advice for Consultation" 2021].

Ecological studies have also shown us that biodiversity is essential for carbon storage, oxygen production, biogeochemical cycling, decomposition, biomass production, habitat provision, and soil and sediment stability, which collectively and synergistically create the "ecological complexes" that species form to produce ecosystem services that humans depend upon for wellbeing (Steve Urlich, Simon Thrush, Judi Hewitt and Eric Jorgensen "What it means to "maintain" biodiversity in our coastal marine environment" April 2021 RMJ 25].

However, the Natural and Built Environments Act Exposure Draft (Exposure Draft) has omitted a definition of biodiversity. This will need to be addressed, and to be consistent with existing legislation and international obligations: such as the Resource Management Act 1991 (RMA), Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (EEZ), Environmental Reporting Act 2015 (ERA); 1992 international Convention on Biological Diversity (CBD) ratified by New Zealand in 1993; 2019 draft National Policy Statement – Indigenous Biodiversity; and the 2020 Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy (ANZBS).

Biodiversity is therefore much broader and more encompassing of ecological processes than "the variety of life". It provides the "hidden infrastructure" that provides us with oxygen, waste assimilation, food, fibre, recreation, and cultural and spiritual sustenance, and thereby underpins the ecological systems (ecosystems) which enable us to survive and for our societies to thrive.

The Exposure Draft does include mention of ecological processes and functions along with the ability of an ecosystem to support and maintain habitat structures, along with resilience to the adverse impacts of natural or human disturbance [at pt 1, cl 3]. What does this mean for the 150-year history of extractive clearfelling, which has become embedded in the economy within industries such as plantation forestry on steepland hill country and extensive bottom-trawling – two of our most ecologically damaging activities?

Let's examine the recent storm in Marlborough where ~300 mm rain caused widespread flooding and slips in July. The storm had a range of impacts on different land uses; the extent and type are currently being analysed by the Marlborough District Council, with respect to predisposing risk factors such as soil type, slope, aspect, and elevation. Extensive slipping occurred in recently harvested plantation forestry (Figure 1, at 24). There were also slips in intact pine plantings, regenerating indigenous forest, and pastoral farms on low hill country, where the impacts were more localised, albeit posing real risk to life and damage to property (Figure 2), at 24.

The determination of ecological limits to safeguard ecological integrity, as set out in the Exposure Draft, could preclude the clearfell harvesting and blanket replanting of the hillside in Figure 1. This is because the severe erosion and consequent damage from debris and deposited soil in the wetland, stream, and then coastal environment does not meet the Purpose of the new Act: to uphold *Te Oranga o te Taiao* [pt 2, cl 5].

Te Oranga o te Taiao incorporates the health of the environment; *and* the intrinsic relationship between iwi and hapū and te Taiao; *and* the interconnectedness of all parts of the natural environment; *and* the essential relationship between the health of the natural environment and its capacity to sustain all life [pt 2, cl 5(3)].

The loss of soil structure, organic carbon, the fungal network, soil biodiversity, stability, and the downstream externalities from sediment (Figure 1) is contrary to *Te Oranga o te Taiao*. This is not an isolated case, as has been evidenced after a number of significant storm events in Tasman, Gisborne and Marlborough (Figure 3, at 25). In addition to debris flows, relatively minor storms also cause sediment deposition from diffuse overland flow.

The Exposure Draft is silent on carrying forward the 2010 New Zealand Coastal Policy Statement (NZCPS). The NZCPS set environmental bottom-lines policies for estuaries and inshore coastal waters, benthic ecosystems, and threatened species. Its Objective 1 also sought to safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems and processes. This is similar to *Te Oranga o te Taiao*.

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Figure 1: Multiple debris flows originating from mid-slope failures and from fill associated with forestry road construction on land classified as "Orange" (high risk of erosion) under the National Environmental Standard for Plantation Forestry (NES-PF). The soil and slash has ended up in a wetland scheduled in the Proposed Marlborough Environment Plan under s 6(c) of the RMA. Photo: Marlborough District Council, July 2021.

Figure 2: Landslides in regenerating indigenous forest (left), pastoral farm (centre), and mature pine plantation (right) after the July 2021 storm in Marlborough Sounds and contributing catchments. Photos: Marlborough District Council.

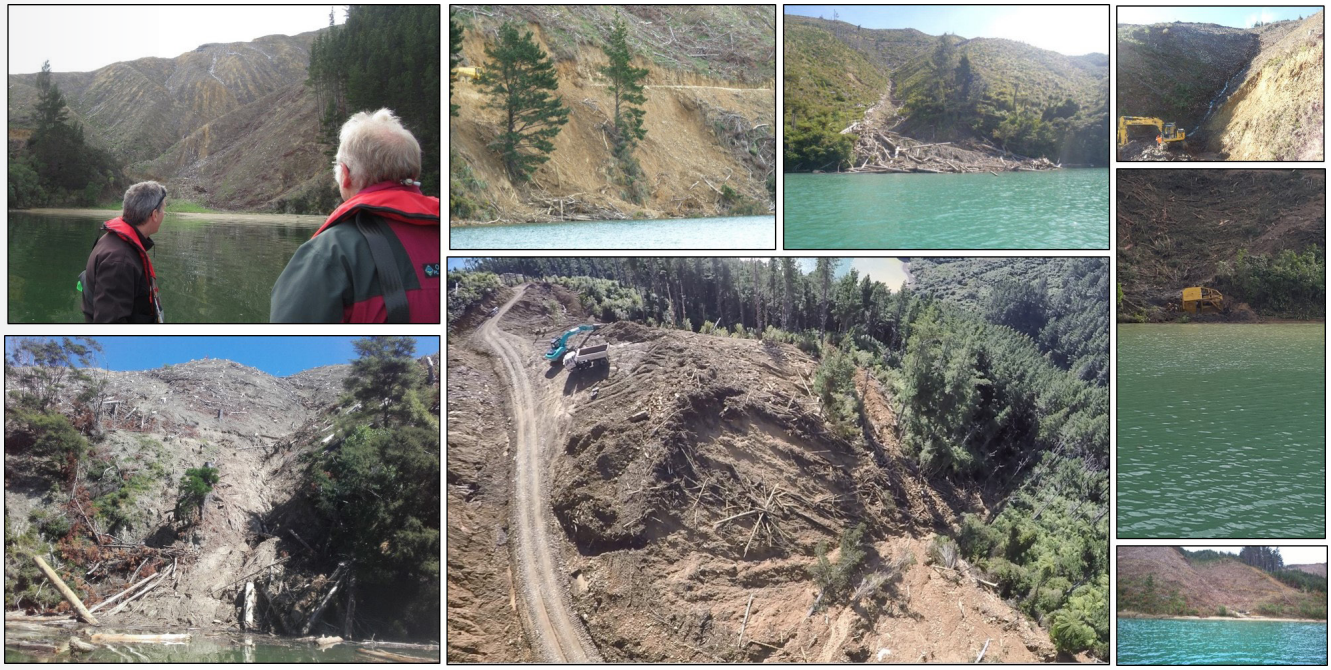

Figure 3: Selected examples of avoidable forestry induced soil erosion and landslides in the Marlborough Sounds after minor and major storm events since 2011, reflecting inadequate regulation. Photos: Marlborough District Council.

The relationship to existing national environmental standards in the Exposure Draft is also unclear. This includes the Resource Management (National Environmental Standard for Plantation Forestry) Regulations 2017 (NES-PF). This instrument allows the continued clearfelling and blanket replanting on the shallow soils of the erodible gullies of the hillside in Figure 1 and in many "orange zoned" lands under the NES-PF's erosion susceptibility classification tool. The Proposed Marlborough Environment Plan 2020 (PMEP) also does not address these issues effectively, despite having the opportunity to put a range of necessary restrictions under reg 6 of the NES-PF (Steve Urlich "Opportunities to manage sediment from forestry more effectively in the Marlborough Sounds and contributing catchments" (2020) 65 NZ Journal of Forestry 28].

The situation is similar in the Gisborne and Tasman Districts, where the continued clearfell practices on erosion-prone steeplands have been questioned [For example, James W Griffiths, Claire Lukens and Roger May "Increased forest cover and limits on clear-felling could substantially reduce landslide occurrence in Tasman, New Zealand" (2020) 50 NZ Journal of Forestry Science 1]. The question arises as to whether the Exposure Draft will be able to drive the innovation in forest practices needed to reduce significant, ongoing and widespread ecological damage. The Exposure Draft has similar objectives to the NZCPS, but the NZCPS has not driven such innovation in regional council plans to date. Excessive sedimentation smothering estuarine and inshore ecosystems may well continue under the NBEA without concerted political and institutional will.

NES-PF YEAR 1 REVIEW

The innovation of mandatory replanting management plans was called for in the development of both the NES-PF and PMEP (Steve Urlich "Mitigating fine sediment from forestry in coastal waters of the Marlborough Sounds" (2015) Marlborough District Council 15-009].

The aim was to retire steep gully heads and faces, incised gullies, and other critical source areas for erosion, with mandatory plans to be approved by councils. Without the requirement to retire critical erosion sources, the blanket replanting and clearfell harvesting regime would in effect be "locked in", thereby exposing soils across the landscape to a plausibly high risk of severe erosion, particularly as rainfall intensities increase under climate change. These calls were not heeded, and therefore situations as in Figure 1 seem destined to reoccur.

There is not a lack of scientific and technical knowledge about these issues to inform plan makers. For example, it has been over 45 years since the first complaint was made about excessive sedimentation into the Marlborough

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Sounds from forestry harvesting and associated earthworks [Steve Urlich, 2020 at 31]. Despite decades of ensuing scientific research, regulation remains permissive, and the causes of erosion unaddressed.

Hill country soils in the Marlborough Sounds, as in other parts of the country, had a long history of erosion once the forest cover was removed, which led in 1941 to the Soil Conservation and Rivers Control Act. The Objects of that Act were (a) to promote soil conservation; (b) prevent and mitigate soil erosion; (c) prevent damage of floods; and (d) utilise land in such a matter to tend towards attainment of (a)–(c). However, repeated burning of indigenous scrub species as "pasture weeds" from the late 1800s up to the 1980s diminished soil carbon and organic matter, and made the soils more vulnerable to erosion under heavy soils. Even soils under regenerating indigenous forest have not had sufficient time to fully regenerate their matrix and stabilise hills.

The recent government review of the NES-PF reflects the regulatory system inertia (Te Uru Rākau "Report on the Year One Review of the National Environmental Standards for Plantation Forestry" (April 2021) Forestry New Zealand). In recognising the requirement for "a transition path to improved risk assessment, management practice, and replanting, or else retirement" [at 22], the recommendations do not specify how this is to occur.

The review essentially says regulation of steepland forests is difficult, and that the industry and councils should share ideas and best practices to reduce erosion risk. It acknowledges that the existing erosion-susceptibility maps are too coarse [at 22], but the solution is to continue with the status quo [at 67], and hope that a future contestable science funding process will deliver finer-scale slash management tools fit for regulation [at 22].

Te Uru Rākau advised its Ministers that although there are issues with forestry slash (branches, crowns) "in gully heads and on convex slopes above rivers", the NES-PF only partially regulates this, and only considers that it could only "possibly" be regulated as it is "challenging to determine as site specific" [at 25].

It is not clear what data underpin the findings, the scientific work that informed the analysis, nor are contrary views and recommendations referenced or discussed [e.g. Madeline Wright, Sally Gepp and David Hall "A review of the Resource Management (National Environmental Standards for Plantation Forestry) Regulations 2017" (2019) Environmental Defence Society & Royal New Zealand Forest & Bird Protection Society].

Te Uru Rākau did examine the imposition in council plans of more stringent regulations than the NES-PF (reg 6) for protection of wetlands, freshwater and marine ecosystems, and significant natural areas and landscapes. Which councils were surveyed, what questions were asked, and the raw or summary data are all not included. The Ministers thereby have no empirical basis on which to rely on the statement that: "it is hard to link some cases where stringency is applied to an environmental benefit" [9.1 at 46]. This is important, as "stringency is seen as a major cause of inconsistency and additional cost by resource users" [9.1 at 46]. Te Uru Rākau acknowledged that they could not set policy around the setting or implementation of more stringent rules, and that: "Further work is required to identify how the stringency provision has been interpreted, the impact this is having on nationally consistent outcomes, and providing guidance on its use" [9.3.5 at 48].

Te Uru Rākau advised Ministers that the NES-PF is effective, with suggested only relatively minor changes to attempt to lift council and industry performance to improve environmental outcomes. However, by not introducing mandatory replanting plans and/or progressively retiring high risk erosion-prone landforms, the situation in Figures 1 and 3 will continue to be normalised.

STRATEGIC ISSUES FOR NBEA AND SPATIAL PLANNING ACT

Aotearoa New Zealand has a long history of extractive clearfelling, which has become embedded in the modern economy. These practices are increasingly maladaptive as ecological resilience is eroded, and path dependency and weak institutional cultures make it difficult to bring about needed change.

We have not come very far since Humboldt's observation about the need for ecological understanding and connection. If we had, planning provisions would encourage regenerative soil management and conservation in recognition of the history of deforestation, which has had devastating downstream effects [Steve Urlich and Sean J Handley "From 'clean and green' to 'brown and down': a synthesis of changes to biodiversity and marine ecosystems in the Marlborough Sounds, New Zealand (2020) 198 Ocean and Coastal Management].

Ecological processes such as disturbance, recruitment, succession, adaptive capacity, facilitation, competition, coexistence, stability, and connectivity are implicit in the definition of "Ecological Integrity" in the Exposure Draft [pt 1, cl 3]. These concepts may need to become more explicit to identify and address cumulative effects, multiple stressors, tipping points and hysteresis to better understand what *Te Oranga o te Taiao* may look like in different ecosystems at different scales, and in defining "environmental limits" and "outcomes".

The language in the Exposure draft around limits is especially concerning to an ecologist. How "the minimum biophysical state of the natural environment or a specified state" [at pt 3, cl 7(3)(a)] is to be defined will be challenging and require a significant amount of ecological data, analysis, and interpretation. How "the maximum amount of harm or stress that may be permitted on the natural environment or on a specified part" [cl 7(3)(b)] is equally difficult to determine, and may well lead to multiple and interacting tipping points.

The steepland forestry industry has already arguably exceeded the minimum environmental state and caused maximal harm to the soil and fungal ecosystem, and ongoing damage to freshwater and coastal ecosystems. Forests in many parts of the erosion landscape on red and orange zoned areas may be best left unharvested or in continuous cover to help address the biodiversity and carbon crises [Madeleine Wright and others at 26].

The institutional acceptance of current forestry practices for example, points to a significant set of strategic issues for the NBEA. First, it is questionable whether government ministries with a purpose to support primary industries should be setting the underpinning regulations. The development of the NES-PF was removed from the Ministry for the Environment (MfE) by the previous National-led government. These types of divided mandates create perceptions of conflicts of interests, which has also dogged fisheries regulation. Both central and regional regulators have enabled maladaptive ecological practices and so co-created environmental issues.

Second, the lack of confidence by successive governments in the Ministry for the Environment (MfE) does not bode well for the design and ongoing implementation of the NBEA. For example, the current government has placed the Oceans and Fisheries secretariat within the Department of Conservation, despite MfE leading the 2016 Marine Protected Areas reform process. There may be myriad reasons for this, nevertheless the NBEA needs a strong nature-centric regulatory agency that is bicultural in structure and relational in its tikanga.

Third, there is no reference to the NZCPS, which is mandatory under the RMA. This established national "bottom lines" as recognised in *EDS v King Salmon*. It would be a mistake to not carry the NZCPS forward. That said, national environmental standards, such as the NES-PF, will likely require significant realignment to give effect to *Te Oranga o te Taiao*. This needs to occur irrespective of the current resource management reform.

These will require a major expression of political will. Small communities in remote areas heavily dependent on forestry in steepland areas are likely to require transitional support, as practices are changed over time. These "just transitions" would seem to be a logical component of the Strategic Planning Act, as land use change is inevitable, driven by increasing environmental standards, population pressures, and new technologies.

There are strong calls from scientists for transformative change in the ways we interact and derive our living from nature. Humboldt's holistic systems thinking is needed within our regulatory regimes and institutions, along with an awareness of the interconnection and vulnerability of ecological processes which sustain all life. To that end, "Ecologies" should perhaps replace "Environments" in the NBEA as an enduring reminder.